FELLING AND BURNING TO PREPARE SOUTHERN APPALACHIAN SITES OCCUPIED BY MOUNTAIN LAUREL[1]

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Abstract—This study tested felling of residual stems and summer site preparation burning as means of controlling mountain laurel (*Kalmia latifolia* L.) to facilitate the establishment of a pine-hardwood stand after clearcutting. Three replications of two treatments (fell-only and fell-and-burn) were established and measured after one, three, and seven growing seasons. Mountain laurel height was significantly less in the fell-and-burn plots than in fell-only plots. Both treatments appeared to reduce mountain laurel density and crown cover significantly. Pines and hardwoods grew well and overtopped the mountain laurel in both treatments. Burning significantly reduced the height of the hardwoods and increased the height of the pines. However, these differences were relatively small, indicating that burning may not be necessary if harvesting sufficiently damages the mountain laurel understory.

INTRODUCTION

As a result of fire exclusion, reduced grazing, and increased timber harvesting, mountain laurel (*Kalmia latifolia* L.) probably covers a larger area in the Southern Appalachian mountains today than ever before. This shrub commonly forms a dense understory that can interfere with the regeneration of commercially valuable trees. On the Andrew Pickens Ranger District, Sumter National Forest, in northwestern South Carolina, managers estimate that competition from mountain laurel reduces the amount of harvested land that can be regenerated by up to 15 percent. After clearcutting in the Southern Appalachians, a mountain laurel understory is often left standing because heavy machinery use on steep slopes is limited and chainsaw felling is expensive.

Several studies report attempts to control mountain laurel, but emphasis has been placed on expensive techniques. Wahlenberg (1950) found that mechanical means were successful in controlling laurel and rhododendron, but the cost was high. Sluder (1958) found that foliar and basal sprays were unsuccessful. Yawney (1962) was able to kill rhododendron with a basal spray of 2.4, 5-T, but according to Hooper (1969), the costs ran about $137 per acre.

Site preparation burning may provide an inexpensive means of controlling mountain laurel. Hooper (1969) noted that documented evidence of intentional burning in the mountains is limited. Keetch (1944) experimented with prescribed burning and found that a good stand of oak sprouts formed after one to three burns. However, fire intensity may be too low in dense sprout-clusters to top kill mountain laurel stems. Moreover, mountain laurel sprouts may out compete the desired pines and hardwoods after burning. This study tested felling of residual stems and felling plus summer burning as inexpensive ways to control mountain laurel and regenerate mixed pine-hardwood stands after clearcutting.

METHODS

Three stands supporting dense mountain laurel understories on the Andrew Pickens Ranger District in Oconee County, South Carolina were selected for this study. These stands were clearcut in 1986 and regenerated to pine-hardwood mixtures by the fell-and-burn technique (Abercrombie and Sims 1986, Phillips and Abercrombie 1987). Prior to harvest, the overstory was mixed oak and pine (Table 1) with a dense understory of mountain laurel (> 60 percent cover). The mountain laurel averaged 12.4 feet tall with 1,000 or more stems per acre (Table 2).

Each stand was a block in a randomized complete block design. To examine the effects of fire on mountain laurel regeneration, two treatments were installed in each block: 1) a fell-only treatment and 2) a fell-and-burn treatment. To measure stand development, three 14-x 14-meter measurement plots were established in each of the two treatments areas within each stand.

Contract crews felled residual stems in May 1987. All pine and hardwood stems over 5-feet tall were felled with chainsaws and left on study plots. Following Ranger District procedures, crews did not fell mountain laurel stems.

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Table 1-- Species composition prior to harvest

Species	Stems	Basal Area
	(#/ac)	(ft^2/ac)
Oaks		
Scarlet	25	14.8
Southern Red	8	3.7
White	22	12.2
Pines		
Shortleaf	16	15.9
Virginia	9	3.4
White	14	5.5
Red Maple	46	6.4
Sourwood	54	11.3
Misc. Hardwoods	55	10.2
Total	249	83.4

Table 2--Number and height of mountain laurel sprout clumps by treatment and year

Sample Period	Clumps (#/ac) Fell & Burn	Clumps (#/ac) Fell Only	Height (ft.) Fell & Burn	Height (ft.) Fell Only
Preharvest	1,164a[1]	995a	12.0a	12.8a
Year 1	409a	423a	0.6a	2.0 b
Year 3	551a	735a	1.7a	2.6 b
Year 7	355a	536a	4.3a	5.5 b

[1]Means followed by the same letter within a row are not significantly different at the 0.05 level.

Site preparation burning was conducted in July 1987 using the spot fire technique with aerial ignition by helitorch. Fire lines were plowed around fell-only treatment plots and pumper trucks were used to prevent spotting. Wind speeds ranged from 5 to 9 miles per hour and relative humidity was 55 percent. High intensity fires, with a maximum flame height 12 to 15 feet, removed most of the logging slash. However, because only the litter layer was consumed, the organic mat was left to protect against surface erosion.

White pine seedlings were planted at a 12 by 12-foot spacing (302 per acre) during the following winter.

Sample plots were measured at the end of one, three, and seven growing seasons after treatment (1988, 1990, and 1994). Measurements included height and number for pines, hardwoods (by species), and mountain laurel. Crown diameter was also measured for mountain laurel sprout-clusters. Regeneration has been documented from 1987 to 1994.

RESULTS

The harvesting and felling operations used in this study reduced mountain laurel presence more than anticipated. With the fell-only treatment, the number of mountain laurel sprout-clusters was reduced from 995 per acre prior to harvest to 423 per acre at the end of the first growing season (Table 2). Mean height of mountain laurel was reduced from 12.8 feet to 2.0 feet without burning. In study plots that were felled and burned, mountain laurel height was less than in fell-only plots and remained significantly shorter throughout the seven-year study period.

Crown cover of mountain laurel was reduced in both treatment areas from over 90 percent to less than 5 percent by felling and harvesting operations (Figure 1). In the fell-and-burn areas, crown cover was reduced to near-zero levels and remained significantly lower than in the fell-only areas throughout the study period (Figure 1). Mountain laurel crown cover remained below 30 percent in both treatment areas through seven growing seasons.

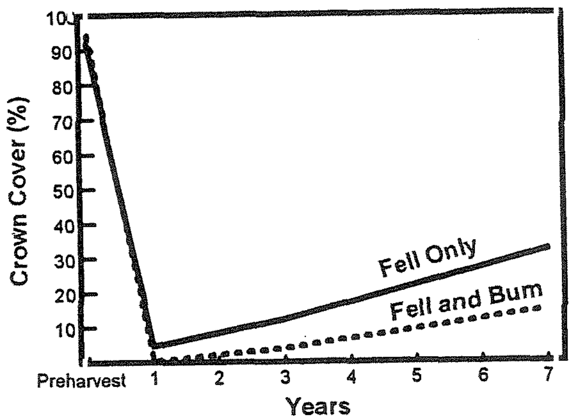

Figure 1--Percent crown cover of mountain laurel by treatment.

Burning in this study reduced hardwood competition with planted pines more than it reduced mountain laurel abundance. Hardwood stem density during years one and three was significantly less in burned plots. However, this difference was not apparent at year seven (Table 3). Burning reduced the height of hardwoods by reducing the length of the first growing season. This difference was significant for all hardwood species for the first three years after treatment and for sourwood during the seventh year (Table 3).

While the difference in the survival of planted pines between the two treatments was not significant, height growth was greater in the fell-and-burn treatment plots

Table 3--Density and height of hardwood sprouts by species group, treatment, and year

	Density (#/ac)		Height (ft.)	
	Fell & Burn	Fell Only	Fell & Burn	Fell Only
YEAR 1				
Oaks	39a	56a	1.7a	2.5 b
Red Maple	87a	440 b	1.8a	4.3 b
Sourwood	33a	267 b	1.6a	3.9 b
Others	32a	315 b	2.2a	3.0 b
Tot/Avg	191a	1,078 b	1.8a	3.5 b
YEAR 3				
Oaks	0a	220a	—	4.7
Red Maple	1,010a	1,450a	6.6a	10.3 b
Sourwood	550a	310a	4.4a	5.5a
Others	330a	1,530a	3.0a	4.6 b
Tot/Avg	1,870a	3,510 b	4.3a	5.6 b
YEAR 7				
Oaks	292a	286a	8.9a	6.3a
Red Maple	596a	577a	4.0a	5.9a
Sourwood	247a	357a	9.2a	17.5 b
Others	1,214a	1,660a	7.5a	6.5a
Tot/Avg	2,349a	2,880a	7.3a	8.2a

Means for density or height followed by different letters within a row are significantly different at the 0.05 level.

(Table 4). During year seven, 245 pines per acre were counted in fell-and-burn treatment areas, but this was not significantly different from the fell-only treatment areas. A large number of volunteer pines was observed during the third growing season after treatment but these pines did not persist through year seven. Pine height growth was slow in both treatments during the first three growing seasons. By the end of the seventh year, however, pines in fell-and-burn treatment plots were significantly taller than in fell-only areas (13.6 feet vs. 11.2 feet). This difference probably results from controlling mountain laurel and hardwood sprouts provided by site preparation burning.

Table 4--Number and height of pines by treatment and year

	Density (#/ac)		Height (ft.)	
Sample Period	Fell & Burn	Fell Only	Fell & Burn	Fell Only
Year 1	302a[1]	302a	0.5a	0.5a
Year 3	764a	332 b	2.3a	2.1a
Year 7	245a	292a	13.6a	11.2 b

[1] Means for density or height followed by the same letter within a row are not significantly different at the 0.05 level.

SUMMARY AND CONCLUSIONS

The results of the experiment indicate that burning can be used as a tool for temporary control of mountain laurel but it may not be necessary. The great reduction of mountain laurel by the harvesting and felling operations was unexpected. Hardwood density was less in burned plots through the third growing season but matched the fell-only areas after seven years. Hardwoods killed back by fire grew for only part of the first growing season. After seven years, pine density did not vary by treatment, but pine heights were significantly greater in burned plots. Although burning appears to reduce competition from mountain laurel, the minimal gains in pine height growth are probably not worth the extra expense and added risk of burning. Burning may prove beneficial in areas where harvesting does not damage mountain laurel understory as much as was observed in this study.

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